Health Psychology
2007, Vol. 26, No. 4, 428–436

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0278-6133/07/$12.00 DOI: 10.1037/0278-6133.26.4.428

# Personality and Mortality Risk Across the Life Span: The Importance of Conscientiousness as a Biopsychosocial Attribute

Leslie R. Martin
La Sierra University

Howard S. Friedman
University of California, Riverside

Joseph E. Schwartz
Stony Brook University, State University of New York

***Objective:*** This study addressed whether personality in childhood and personality in adulthood are independent predictors of mortality risk and the extent to which behavioral and other psychosocial factors can explain observed relationships between personality and mortality risk. ***Design:*** This was a prospective longitudinal cohort study of 1,253 male and female Californians over 7 decades (1930–2000). Proportional hazards regressions were the principal analyses. ***Main Outcome Measures:*** Mortality risk (in the form of relative hazards) was the primary outcome. Additional tests of mediators and moderators ascertained whether associations between personality and mortality risk remained significant when psychosocial and behavioral variables were statistically controlled. ***Results:*** The findings, including a new 14-year additional follow-up in old age, revealed that conscientiousness, measured independently in childhood and adulthood, predicted mortality risk across the full life span. The link from childhood remained robust when adult conscientiousness and certain behavioral variables were controlled. Psychosocial and behavioral variables partly explained the adult conscientiousness–longevity association. ***Conclusion:*** The findings demonstrate the utility and complexity of modern personality concepts in understanding health and point to conscientiousness as a key underexplored area for future biopsychosocial studies.

*Keywords:* personality, health behaviors, life-span mortality risk, conscientiousness

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Personality, a relatively stable set of cognitive–motivational and socioemotional traits and behavior patterns, is increasingly recognized as a meaningful contributor to the prediction of a wide range of important human outcomes. Because it captures a combination of genetic, familial, and sociocultural elements, personality can be an important factor for understanding long-term biopsychosocial processes. In the decades since the Type A behavior pattern was recognized as a possible risk factor for cardiovascular disease, accumulating evidence has suggested that personality, broadly construed, is related to important health outcomes. Increasingly, the five-factor approach to personality, coupled with attention to trait–environment interactions, has drawn some focus away from narrower and more pathology-based concepts like Type A, anxiety, repression, reactivity, inhibition, and delinquency. That is, conscientiousness, extraversion, agreeableness, and neuroticism (and to some extent openness), in the context of situational exigencies, have been shown to be relevant to later important outcomes, including life-span mortality risk (Caspi et al., 1997; Christensen et al., 2002; Danner, Snowdon, & Friesen, 2001; Friedman, Tucker, Schwartz, Martin, et al., 1995; Friedman, Tucker, Schwartz, Tomlinson–Keasey, et al., 1995; Friedman, Tucker, Tomlinson–Keasey, Schwartz, Wingard, & Criqui, 1993; Martin et al., 2002; McCann, 2005; Smith, Gallo, & Ruiz, 2003; Wilson, Mendes de Leon, Bienias, Evans, & Bennett, 2004).

Initially surprising but now increasingly well documented is the finding that conscientiousness may be a key biopsychosocial attribute (Friedman, Tucker, Schwartz, Martin, et al., 1995; Friedman et al., 1993; Martin & Friedman, 2000; McCann, 2005; Roberts & Bogg, 2004; Roberts, Caspi, & Moffitt, 2003; Weiss & Costa, 2005), in part because of its demonstrated links to healthy behaviors (e.g., Hampson, Goldberg, Vogt, & Dubanoski, 2006; Roberts & Bogg, 2004; Tucker et al., 1995). Despite the promise conscientiousness holds for aiding understanding of patterns of individual difference and their associations with health, a number of interrelated questions about conscientiousness have not been addressed. First, there is the question as to whether conscientiousness predicts mortality risk independently in both childhood and adulthood. If childhood conscientiousness has far-reaching, independent effects, then its associations with health and

Leslie R. Martin, Department of Psychology, La Sierra University; Howard S. Friedman, Department of Psychology, University of California, Riverside; Joseph E. Schwartz, Department of Psychiatry and Behavioral Science, Stony Brook University, State University of New York.

This research was supported by National Institute on Aging Grants AG08825 (Howard S. Friedman, principal investigator) and AG15188 (Leslie R. Martin, principal investigator). Part of the data was made available from the Terman Life-Cycle Study, and assistance was provided by Eleanor Walker of the Terman project. We bear full responsibility for death certificate collection and coding, data refinements, analyses, and interpretations. This article is one in a series from our multiyear, multidisciplinary project on psychosocial predictors of health and longevity. Previous publications from the project, including previous studies of personality and longevity using a shorter time period and less complete death data, are cited as appropriate, and care should be taken not to include overlapping findings in meta-analyses or other reviews.

Correspondence concerning this article should be addressed to Leslie R. Martin, Department of Psychology, La Sierra University, 4500 Riverwalk Parkway, Riverside, CA 92515-8247. E-mail: Lmartin@Lasierra.edu or Howard.Friedman@ucr.edu

mortality may be more reflective of fundamental psychophysiological phenomena, such as serotonin function (Williams et al., 2004), than if the prognostic value of childhood conscientiousness is due mostly to its association with later-life (adult) conscientiousness and associated healthy adult behaviors. Second, there is the question of whether the prognostic value of conscientiousness continues across the full life span, into old age. If it does, this would be additional evidence for a fundamental process. Third, there is the related question of the extent to which risk taking (and death from injury) and health behaviors, such as smoking, drinking, and overeating, can explain any lifelong relationships between personality (especially conscientiousness) and mortality risk. Longitudinal data are required to address such questions but are difficult to obtain (e.g., Hampson et al., 2001). No longitudinal studies to date have assessed personality from childhood through the full life span with rich life-course behavioral data.

The present study used new data we collected to follow up the Terman life-cycle cohort, born on average in 1910 (Terman et al., 1925; Terman & Oden, 1947), to predict and explain mortality from 1930 to 2000. Specifically, this article addresses three issues: (a) whether childhood and adult personality variables (especially conscientiousness) are independent predictors of later mortality risk, or whether childhood personality predicts longevity only through its association with adult personality; (b) the associations of personality, in both childhood and adulthood, with mortality risk and cause of death through the year 2000 (when the average participant was deceased or well into his or her 80s); and (c) certain potential mediators and moderators as explanations for observed relationships between personality and mortality risk.

## Method

### *Participants*

The participants were drawn from the original group of 1,528 individuals recruited by Stanford psychologist Lewis Terman and colleagues in the 1920s. Nominated by their teachers and others as excellent students, the participants included by Terman had IQs of at least 135. Consistent with procedures of previous personality studies using this data set to produce a relatively age-homogeneous, school-age initial sample, we excluded participants not born from 1904 to 1915 ($n = 155$), those who died or were lost to follow-up prior to 1930 ($n = 74$), and those missing all childhood personality information ($n = 46$). This resulted in a final sample of 1,253 (706 male) participants, 99% White and mostly middle class, who were born on average in 1910. The 275 excluded individuals did not differ systematically from those retained for analysis on the dimensions of sex, intelligence, parents' socioeconomic status, or ethnicity.

In addition to addressing new questions regarding the persistence of personality effects when certain variables are controlled, the data herein represent a significant expansion on our previous work (Friedman et al., 1993), as the time period for predicting mortality risk is now extended an additional 14 years (1986–2000). Further, we have now identified some individuals who were previously lost to the study but were still presumed alive; that is, we have verified some of them as still living and documented date and cause of death for others. (As of 2000, 789 participants in this sample had been verified as deceased.)

### *Personality Variables*

We developed a set of reliable personality measures from the first of Terman's assessments, made in 1922 (based on parent and teacher reports, it is described elsewhere; Friedman et al., 1993). Of these childhood measures, four (conscientiousness–social dependability, cheerfulness–humor, sociability, and permanency of mood) were utilized in the present study because of their documented association to the five-factor model (John, 1990; McCrae & Costa, 1987; McCrae & John, 1992) constructs of Conscientiousness, Agreeableness, Extraversion, and Neuroticism (Martin & Friedman, 2000).[1] Table 1 reports the reliabilities for these scales.

Using factor analysis, testing for measurement invariance, and rational analysis, we also created adult personality scales for four of the Big Five (Conscientiousness, Agreeableness, Extraversion, and Neuroticism) from data collected in 1940 (average participant age = 30 years; Martin & Friedman, 2000). The item content seems insensitive with regard to measurement of openness, and this is the most likely explanation for the failure of openness to emerge as a factor (Martin & Friedman, 2000). These 1940 personality scales were then used as models for selecting items to construct similar personality scales from self-report data collected in 1950.[2] Table 1 reports the alpha reliabilities of these 1940 and 1950 adult personality scales as well as their test–retest correlations.

We averaged the 1940 and 1950 scale scores for each of the four personality scales (standardized and adding a constant to eliminate negative values) for those who had personality data available at both time points ($n = 731$). For participants who had personality data for only one assessment ($n = 291$ with 1940 data only; $n = 50$ with 1950 data only), the available decade was used to indicate adult personality. The decision to define adult personality in this way was made to maximize the number of participants with personality data (given the high correlations between 1940 and 1950) while also minimizing

[1] The childhood conscientiousness scale included prudence–forethought, freedom from vanity–egotism, conscientiousness, and truthfulness; the cheerfulness–humor scale included cheerfulness–optimism and sense of humor; sociability included fondness for large groups, popularity, leadership, preference for playing with others, and preference for social activities; permanency of mood was a single item.

[2] The adulthood conscientiousness scale included being thrifty and careful about making loans, making excuses (−), enjoyment of planning work in detail, driving self steadily in work, being impulsive (−), persistence, and having definite purposes for apportioning time and energy; the agreeableness scale included trying to avoid arguments, trying to get one's own way (−), upbraiding those who don't complete tasks on time (–), being critical of others (−), avoiding hurting others' feelings, ignoring the feelings of others (−), having an extra good opinion of self (−), losing one's temper easily (−), being dominant with the opposite sex (−), being easy to get along with, and being vain and egotistic (−); the extraversion scale included taking the lead to enliven a party, preferring a play to a dance (−), being a "stay-at-home" versus a "gadabout" type (−), preferring a quiet mate (−), preferring to have many women friends, enjoyment of social contacts, and having exclusive friendships (−); the neuroticism scale included being very affected by praise/blame, feeling miserable, being touchy, having periods of loneliness, feeling lonesome with others, being bothered with useless thoughts, feeling burdened with remorse/regret, lacking self-confidence, worrying over humiliating experiences, alternating between happiness and sadness without apparent reason, having easily hurt feelings, finding it difficult to be serene/cheerful, being moody, being self-confident (−), being emotional, having sensitive feelings, and suffering from feelings of inferiority.

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Table 1
*Personality Scales, Alpha Reliabilities, and Descriptive Statistics*

| | α reliability | | | Test–retest |
|---|---|---|---|---|
| Personality variable | 1922 | 1940[a] | 1950[b] | 1940/1950 |
| Childhood | | | | |
| Conscientiousness | .76 (4) | | | |
| Cheerfulness-humor | .52 (2) | | | |
| Sociability | .65 (5) | | | |
| Permanency of mood | single item | | | |
| Adulthood | | | | |
| Neuroticism | | .85 (17) | .68 (8) | .87 |
| Agreeableness | | .72 (11) | .66 (4) | .75 |
| Extraversion | | .65 (7) | .65 (3) | .66 |
| Conscientiousness | | .65 (7) | .71 (5) | .71 |

*Note*. The number of items per scale is shown in parentheses.
[a] $n = 1{,}022$. [b] $n = 781$.

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measurement error for those with data at both 1940 and 1950. Less than 5% had data at 1950 only.

## *Potentially Explanatory Variables*

*Alcohol use.* Participants answered questions about their own alcohol use in 1950 and 1960. For each decade, we categorized participants as (a) never drink or only rarely, (b) drink moderately (never or seldom intoxicated), or (c) heavier drinkers. For individuals with alcohol data at both time points, we used the report that indicated heavier drinking as our measurement.

*Smoking.* Data on smoking were not collected as part of Terman's original study. Our team did, however, collect this information (retrospectively) in 1991–92 through self- or next of kin report. Number of pack years smoked was calculated as (years participant smoked × average number of cigarettes smoked per day during the time participant smoked) / 20. The number of pack years ranged from 0 (never smoked) to 180. These data likely underestimate the effect of smoking, because information on heavy smokers who died very young appears more likely to be missing.

*Body mass index (BMI).* Participants reported their weight and height as part of the 1940 assessment. We used this self-report information to calculate BMI using Quetelet's formula: BMI = weight in kg / height in $m^2$.

*Risk taking.* Participants reported on their hobbies and leisurely pursuits (by listing them in an open-ended format) several times from 1922 to 1940. These activities were compiled and rated independently by two coders (trained psychology graduate students) according to whether the activity involved risk (e.g., piloting small airplanes was considered risky, whereas stamp collecting was not); participants were then categorized according to whether they engaged in at least one risky activity (Martin et al., 2002). This method was utilized, rather than a continuous format, because no information on frequency was available. Thus, a summation of risky activities might yield a high score for someone who had tried a number of risky endeavors only once, as opposed to a person who regularly engaged in a single high-risk activity. The dichotomous categorization offers less precision (and effects associated with this measure are likely attenuated), but it also minimizes misclassifications of the type described above.

*Mental health.* In 1950, Terman and his research team classified participants into one of three categories based on their responses to questions in 1936, 1940, 1945, and 1950, as well as personal interviews. These classifications were (a) showing serious maladjustment, (b) showing some maladjustment, and (c) satisfactorily adjusted (Martin et al., 1995).

*Education.* Cumulative level of education was reported by participants in 1950, and this was used as a measure of socioeconomic status. Information on income was also available in the data set but included only earned income, although some participants reported other forms, such as room and board. In addition, earned income underestimates socioeconomic status for women who did not work outside the home.

*Cause of death.* Cause-of-death data were recorded from death certificates, most of which our research team gathered from state and county agencies. Each certificate was coded by a certified nosologist for underlying cause of death, using the ninth revision of the *International Classification of Diseases* (U.S. Department of Health and Human Services, 1980). These detailed codes were collapsed into five broad categories: (a) cardiovascular disease, (b) cancer, (c) accident or injury, (d) other, and (e) unknown. In cases where death certificates were not available ($n = 81$), information from next of kin was used by our physician expert on death classification to assign the deaths to one of the above categories.

## *Statistical Analyses*

Proportional hazards regressions, which assess mortality risk while taking age into account, were used to test the associations of childhood and adult personality with longevity and cause of death. We then explored variables that might help to explain these associations and tested for gender interactions. Tuma's RATE program was used for these analyses (Tuma, 1980).[3]

[3] In this article we present results from Gompertz models, having cross-checked the analyses against the more widely used Cox model (which makes no assumptions about the survival curve's shape, assuming instead that the ratio of the hazard functions for participants, whose values of the covariates differ, is not age dependent and that a log-linear function is therefore adequately able to represent the effects of these covariates on hazard rates). Results from the comparable Gompertz and Cox models were very similar in each case.

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Correlations between personality and potential explanatory variables (alcohol use, smoking, BMI, risk taking, mental health, and education) were examined, and those demonstrating significant relationships were included in survival analyses to see if they might elucidate mechanisms by which personality is related to mortality risk. To better understand possible pathways, we also tested whether predictive strength varied across causes of death. A constrained Gompertz proportional hazards model, in which the independent variable predicted equally to all causes of death, was compared with an unconstrained model, in which the independent variable was allowed to predict differentially to individual causes of death. In addition, the well-documented relationship between sex and mortality risk was evident in this sample, and so sex was controlled for in all analyses.

Because the relative hazard represents the increase or decrease in risk associated with a 1-point change on a predictor variable, we present the interquartile relative hazard (InterQ *rh*) for variables with a range greater than 3 points. In these cases, every individual with data was included in the analyses, but the estimated effect indicates the relative risk associated with being at the 75th versus the 25th percentile of the predictor.

## Results

### *Personality and Mortality Risk*

As of the year 2000, 492 (70%) of the men and 297 (51%) of the women in this sample had verified deaths. The median age of death, calculated with Kaplan–Meier estimates, was 72.6 years for men and 74.5 years for women.

*Childhood personality.* Across 7 decades (1930–2000), childhood conscientiousness, InterQ $rh(1252) = 0.81$, $p < .001$, and cheerfulness, InterQ $rh(1252) = 1.19$, $p < .01$, were both significantly related to life span mortality risk, with conscientious children living longer and cheerful children dying sooner. Childhood sociability, InterQ $rh(1252) = 0.96$, *ns*, was unrelated to mortality risk. Permanency of mood (lower neuroticism) was related to decreased mortality risk, although this association was driven by the effect for males. There was no significant gender interaction, and this was the only case in which a gender difference in the direction of the relative hazards was found, male InterQ $rh(705) = 0.89$, $p < .05$; female InterQ $rh(546) = 1.05$, *ns*. These results replicate through the year 2000 our earlier findings (Friedman et al., 1993) that predicted deaths through 1986 (and now include Terman participants who have been newly located by us during the past dozen years as dead or alive).

*Adult personality.* Conscientiousness was the only adult personality variable significantly related to mortality risk from 1950 to 2000, InterQ $rh(1071) = 0.82$, $p < .001$ (see Figure 1). Adult neuroticism, InterQ $rh(1071) = 1.00$, *ns*; agreeableness, InterQ $rh(1071) = 0.94$, *ns*[4]; and extraversion, InterQ $rh(1071) = 1.04$, *ns*, all failed to predict mortality risk from 1950 to 2000.

### *Child Versus Adult Personality*

Both child and adult conscientiousness were shown, in the first set of survival analyses, to be significant predictors of mortality risk. The two scales were reliably but only modestly correlated, $r(1071) = .15$, $p < .01$. Although this is consistent with some recent reports on the measurement of conscientiousness over time (e.g., Shiner, Masten, & Roberts, 2003), other studies have shown considerable stability of the construct over time, and heritability coefficients for conscientiousness are generally robust (e.g., Jang, Livesley, & Vernon, 1996; Loehlin, McCrae, Costa, & John, 1998; Luciano, Wainwright, Wright, & Martin, 2006). The construct of personality change is complex (Caspi & Roberts, 1999), and the more modest correlation shown here likely reflects the fact that the child and adult conscientiousness variables differed in a number of ways, including method (parent and teacher ratings vs. self-report), emphasis on different facets of the construct (the childhood scale was more focused on self-discipline), and developmental stage at the time of assessment (child vs. adult, allowing for real change).

Given that conscientiousness was predictive of mortality risk at both time points, a survival analysis was conducted in which both indicators were entered into the same equation. In this analysis, each indicator of conscientiousness retained statistical significance and with equal strength; each InterQ $rh(1071) = 0.85$, $p < .01$. There was no evidence of a gender interaction with either measure. This analysis indicates that childhood conscientiousness did not predict mortality risk solely through its link with adult conscientiousness (see Figure 2, which plots the predicted probability of death by childhood conscientiousness while controlling for adult conscientiousness).

### *Explanatory Pathways*

Because both child- and adult-measured conscientiousness were predictive of decreased mortality risk, we examined whether relatively high versus low long-term conscientiousness and increasing versus decreasing pathways were differentially related to mortality outcomes (as measured by conscientiousness scores at childhood and adulthood). We thus plotted four predicted survival curves, one for each of the following: (a) an individual in the upper quartile in both childhood and adulthood [+, +], (b) an individual in the upper quartile in childhood and the lower quartile in adulthood [+, −], (c) an individual in the lower quartile in childhood and the upper quartile in adulthood [−, +], and (d) an individual in the lower quartile in childhood and adulthood [−, −]. Figure 3 shows that the highest mortality risk was for those with low conscientiousness at both time points, whereas those who scored high at both time points had the lowest risk. Individuals who were low at one time point and high at the other were nearly identical in terms of risk, regardless of direction of change, and this risk was about midway between the other two.

Causes of death may also be informative regarding the biopsychosocial pathways leading to death, and so analyses treating each

[4] In an earlier article (Martin & Friedman, 2000), the relative hazard (*rh*) associated with agreeableness in the Terman sample was reported as 0.84 ($p < .01$). Because the current study found a weaker relationship ($rh = 0.94$, now not significant), the following differences between that study and this one should be noted: (a) The earlier analysis predicted deaths from 1940 to 1991, whereas the current study predicted from 1950 to 2000; (b) The earlier analysis included only participants who had 1940 personality data available, whereas the current study combined information from 1940 and 1950 when both were available and used either 1940 or 1950 data if only one was available (resulting in different samples for the two studies). Future researchers might note this indication that agreeableness may have some protective effect.

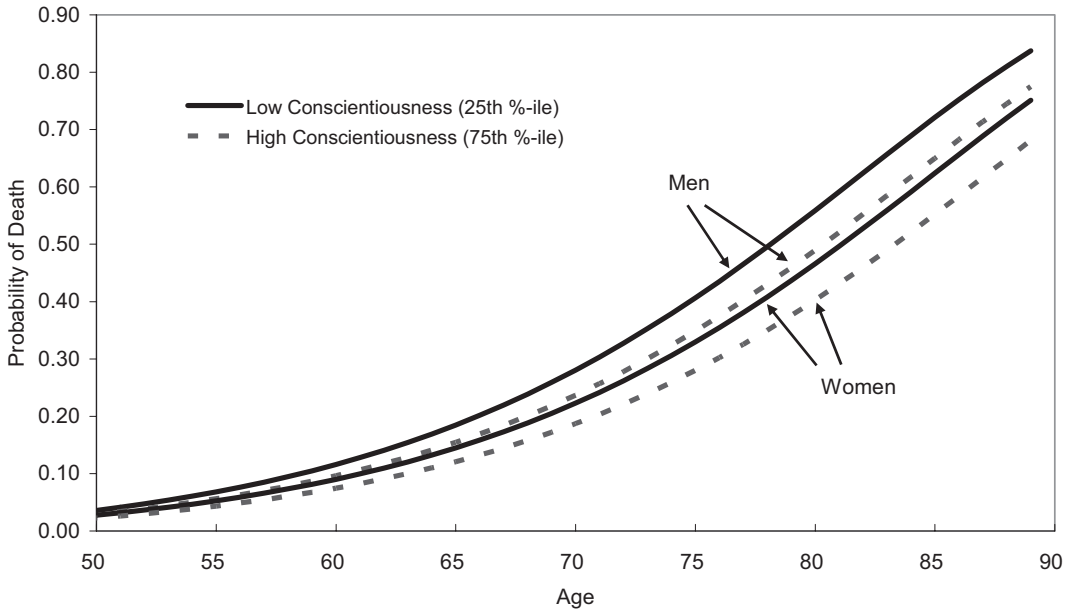


*Figure 1.* Estimated probability of a Terman participant's dying (1950–2000) by a given age, by sex and adult conscientiousness.

cause of death as a separate dependent variable were conducted next. In this sample, 34% of deaths were from cardiovascular disease, 35% were from cancer, 8% were from injuries (trauma), 15% were from other causes, and 7% were from unknown causes. Although there were some slight differences across our five cause-of-death categories in the risk associated with low conscientiousness, these differences were not statistically significant. The most interesting of these differences was that less conscientious individuals were more likely to die from injuries than were those higher on conscientiousness, but perhaps because so few individuals overall died of injury, this trend was not significant.

Next, behavioral and psychosocial variables were examined to better understand the observed personality–mortality associations. These variables were identified by an examination of correlations with the personality predictors. Adult alcohol use, smoking, BMI, risk taking, education, and mental health were all related to one or

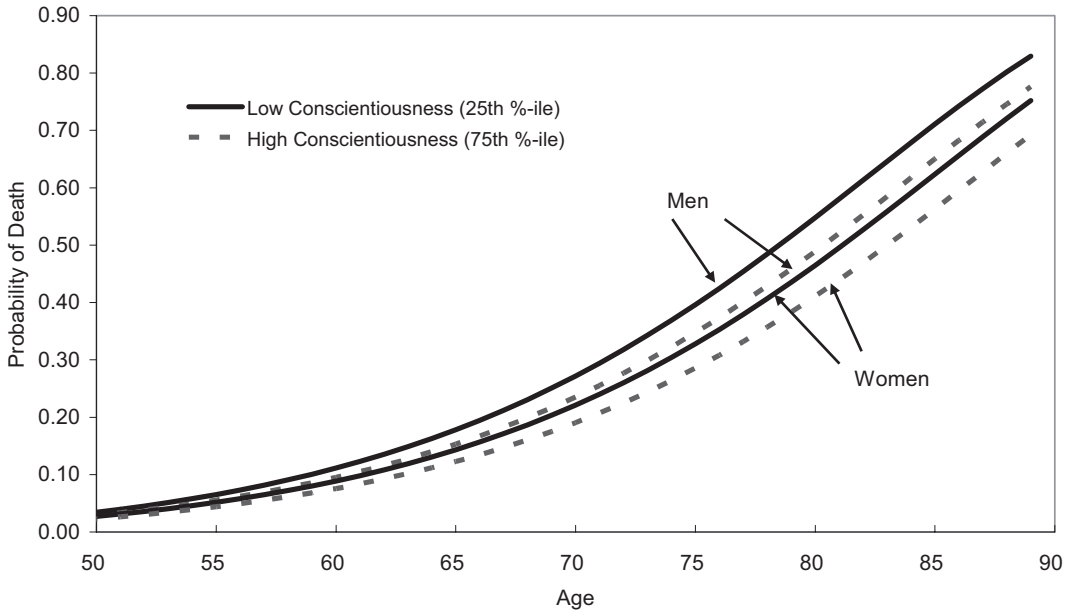


*Figure 2.* Estimated probability of a Terman participant's dying (1950–2000) by a given age, by sex and childhood conscientiousness, controlling for adult conscientiousness.

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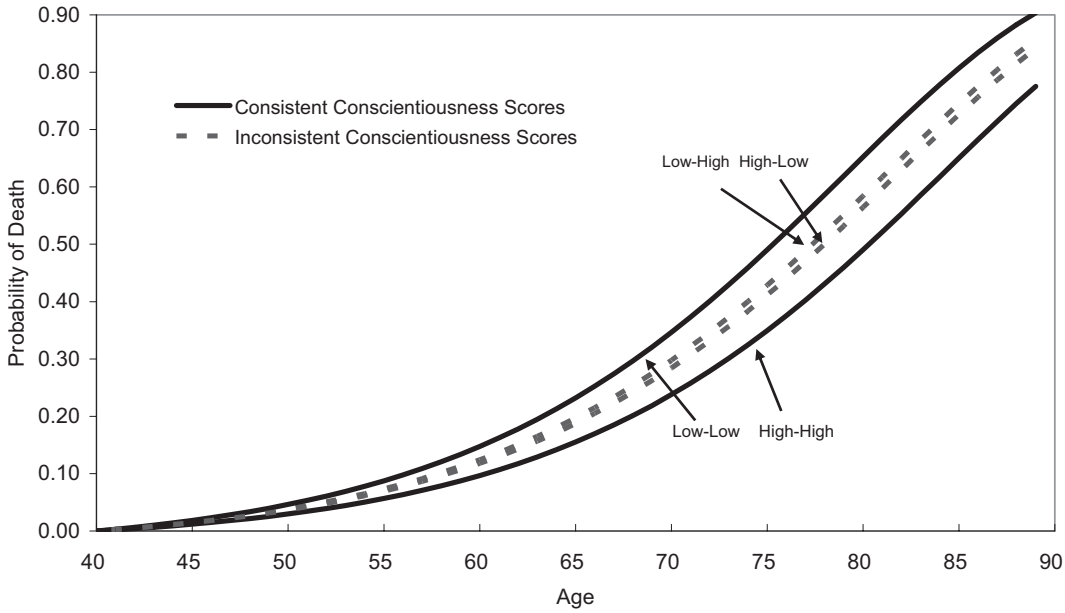


*Figure 3.* Estimated probability of a Terman participant's dying (1950–2000) by a given age, by conscientiousness at two time points.

more of the relevant personality variables (childhood conscientiousness, cheerfulness, and permanency of mood, and adulthood conscientiousness; see Table 2). Therefore, these behavioral and psychosocial variables were entered as controls into proportional hazards regression equations along with the personality variables.

As can be seen in Table 3, the predictive power of childhood conscientiousness was unchanged when alcohol use, smoking, and education were taken into account (compare Models 1 and 2). Adulthood conscientiousness was examined next, along with alcohol use, smoking, BMI, education, and mental health. In the subsample of individuals with data available on all of these dimensions, and with these variables controlled, adult conscientiousness was no longer a significant predictor of mortality risk (compare Models 3 and 4 in Table 3). Childhood cheerfulness also failed to maintain its predictive ability when alcohol use, smoking, risk taking, and mental health were included in the equation.[5] The analysis of permanency of mood for males, controlling mental health and education, indicated that inclusion of these variables in the model did not diminish the predictive power of childhood mood permanency.

## Discussion

This study, which assessed the associations of personality characteristics with mortality risk across 7 decades (1930–2000), confirmed the importance of conscientiousness, measured in both childhood and adulthood, for predicting life span mortality risk. Of importance for understanding process, each characteristic had an independent predictive effect.

The child and adult conscientiousness variables themselves were somewhat different for the two time points, suggesting both the complexity and the power of this basic dimension of personality for understanding health. The childhood measure was derived from parent and teacher ratings and most closely corresponded with the facets of self-discipline and dutifulness as described by the well-validated NEO Personality Inventory—Revised (NEO PI–R; Costa & McCrae, 1992), whereas the adulthood measure of conscientiousness was based on self-report data and was most closely related to the NEO PI–R facets of achievement striving, self-discipline, and deliberation (Martin & Friedman, 2000). Differences in method of assessment, measurement unreliability, and the substantial time lag from 1922 to 1940 and 1950 (including real personality change) are likely contributors to the relative independence of these two conscientiousness measures. Their comparable strength suggests that a full range of conscientiousness facets may be relevant to increased longevity. Their relative independence raises the possibility that childhood personality dimensions change, perhaps becoming more complex, as they encounter a multitude of environments and situations over time, complicating the efforts to ascertain the mediators of their long-term sequelae. These possibilities merit further research.

Childhood conscientiousness remained significantly related to mortality risk when (adult) health behavior and education were controlled. The adulthood conscientiousness relation to mortality risk, however, was meaningfully reduced when behavioral and psychosocial variables were controlled, perhaps due in part to more contemporaneous measurement. In particular, smoking behavior and education level were most relevant, at least for the portion of the sample with complete data on the adulthood control

[5] Because of the dramatic decrease in sample size due to missing data on smoking, Models 2, 4, and 6 were also calculated with smoking eliminated from the equation. For Model 2 ($n$ = 1,011 vs. 642), the relative hazard for conscientiousness remained unchanged at 0.81. For Model 4 ($n$ = 965 vs. 527), the relative hazard for conscientiousness was 0.89 (vs. 0.90) and was marginally significant ($p < .10$). For Model 6 ($n$ = 1,018 vs. 578), the relative hazard for cheerfulness was 0.93 (vs. 0.91) and nonsignificant.

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Table 2
*Correlations of Personality Predictors With Potentially Explanatory Variables*

| Variable | Child con | Child cheer | Child perm mood | Adult con |
|---|---|---|---|---|
| Alcohol | −.13*** (1,136) | .07* (1,136) | −.03 (1,136) | −.15*** (1,068) |
| Men | −.11** (642) | .08 (642) | −.02 (642) | −.22*** (571) |
| Women | −.12** (494) | .06 (494) | −.06 (494) | −.13** (497) |
| Smoking | −.13*** (691) | .19*** (691) | .02 (691) | −.17*** (657) |
| Men | −.15** (359) | .22*** (359) | −.01 (359) | −.20*** (341) |
| Women | −.10 (332) | .15** (332) | .05 (332) | −.16** (316) |
| BMI | −.03 (1,064) | .03 (1,064) | .02 (1,064) | .06 (1,041) |
| Men | .04 (590) | .00 (590) | .02 (590) | .03 (577) |
| Women | −.03 (474) | .04 (474) | −.01 (474) | .01 (464) |
| Risk taking | −.03 (1,253) | .07* (1,253) | −.01 (1,253) | .01 (1,072) |
| Men | −.01 (706) | .08* (706) | −.01 (706) | .01 (600) |
| Women | −.04 (547) | .04 (547) | −.04 (547) | −.01 (472) |
| Mental health | .04 (1,248) | .09** (1,248) | .07* (1,248) | .20*** (972) |
| Men | .09* (711) | .08 (711) | .11* (711) | .26*** (544) |
| Women | −.02 (537) | .09 (537) | .01 (537) | .10* (428) |
| Education | .15*** (1,089) | .01 (1089) | .10** (1,089) | .17*** (1,054) |
| Men | .16*** (614) | .01 (614) | .08 (614) | .12** (593) |
| Women | .17*** (475) | −.02 (475) | .11* (537) | .20*** (461) |

*Note.* Numbers in parentheses are *n*s. Higher values for personality predictors indicate more of the construct or behavior. Child con = childhood conscientiousness; Child cheer = childhood cheerfulness; Child perm mood = childhood permanency of mood; Adult con = adult conscientiousness; BMI = body mass index.
* $p < .05$. ** $p < .01$. *** $p < .001$.

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variables. Given the well-established links between smoking and mortality risk, it is not surprising that smoking (inversely correlated with conscientiousness) explains a portion of the conscientiousness–mortality link in this sample. With regard to education, the fact that achievement striving constituted part of the adult conscientiousness assessment may have reduced the capacity of conscientiousness to relate to mortality risk when education was controlled. Alternatively, those with less education may have experienced more stress throughout adulthood, with a cumulative effect on mortality risk.

Aside from conscientiousness, other personality characteristics gave hints of their possible relevance. Childhood cheerfulness, although now shown to predict increased risk across 7 decades, did not remain a reliable risk factor in the smaller subsample with data on potential adult explanatory variables, either before or after those variables were controlled (this is consistent with our prior findings; see Martin et al., 2002). For boys, permanency of mood remained a significant predictor (with more labile males being at higher risk) and did not appear to function through the pathways of mental health or education. Permanency of mood was not significantly correlated with smoking, alcohol use, risk taking, or BMI.

We confirmed and extended earlier analyses that showed no simple relation between mortality risk and midlife neuroticism or extraversion. This may be because these personality dimensions interact with other aspects of life situations. For example, when people are surrounded by a social circle of smokers and drinkers, the extraverted may be more likely to partake. Similarly, neuroticism may sometimes make one either helpfully cautious (worrying and running to the doctor) or unhelpfully stress prone (overencountering and overreacting to life's tribulations; see Friedman, 2000, 2007). Agreeableness, which had previously been related to decreased mortality risk through 1991, demonstrated only a weaker and nonsignificant trend when examined through 2000 ($rh = 0.94$, *ns*). Thus, the Terman data provide some tantalizing hints about the possible relevance of agreeableness, but these effects are weaker and perhaps more complicated than those of conscientiousness.

This sample, employing our multiyear follow-ups on the Terman data, provides the first detailed life span prospective look at personality and longevity. Few longitudinal studies of individual differences and health are based on a true random sample of the population, and the important question of generality that arises should not be whether any results are fully generalizable (as they usually are not); rather, the focus should be on the likely limits on generality and the purposes for which the results are best used. The Terman data set is especially valuable in helping to avoid overlooking important relationships (i.e., making Type II errors); that is, it helps uncover phenomena that might not be recognizable in cross-sectional studies or in studies of shorter duration. Further, the Terman sample is relatively homogeneous on dimensions of intelligence and social class; a resulting advantage is that these people had the ability to understand medical advice, had opportunities for physical activity, and had routine health care. The sample thus allows a clearer focus on the effects of certain psychosocial variables than would studies on more heterogeneous samples.

The homogeneous nature of the sample with respect to intelligence obviously restricts the range on intellect (openness), but our published studies of the past decade show that there is a more than adequate range of most individual differences; that is, the sample was not selected on the basis of personality, and it is not homogeneous with regard to personality. Analyses by P. S. Sears (1979) showed that attrition has not significantly changed the makeup of the group with respect to a variety of demographic characteristics, including age, income, and education, and other research has confirmed that participants in the Terman sample are similar to other bright, middle-class cohorts (R. R. Sears, 1984; Subotnik,

Table 3
*Personality Predictors Controlling for Behavioral and Psychosocial Variables*

| Personality Predictor | *b* | *rh* | *p* |
|---|---|---|---|
| Model 1 ($n$ = 1,253) | | | |
| Sex | −0.31 | 0.74 | <.001 |
| Child conscientiousness | −0.21 | 0.81 | <.001 |
| Model 2 ($n$ = 642) | | | |
| Sex | −0.33 | 0.72 | <.01 |
| Child conscientiousness | −0.21 | 0.81 | <.01 |
| Alcohol use | 0.01 | 1.01 | *ns* |
| Smoking | 0.30 | 1.35 | <.001 |
| Education | −0.13 | 0.88 | *ns* |
| Model 3 ($n$ = 1,072) | | | |
| Sex | −0.27 | 0.76 | <.001 |
| Adult conscientiousness | −0.20 | 0.82 | <.001 |
| Model 4 ($n$ = 527) | | | |
| Sex | −0.30 | 0.74 | <.05 |
| Adult conscientiousness | −0.10 | 0.90 | *ns* |
| Alcohol use | 0.07 | 1.07 | *ns* |
| Smoking | 0.30 | 1.35 | <.001 |
| BMI | 0.05 | 1.05 | *ns* |
| Education | −0.17 | 0.85 | *ns* |
| Mental health | −0.04 | 0.95 | *ns* |
| Model 5 ($n$ = 1,253) | | | |
| Sex | −0.31 | 0.74 | <.001 |
| Child cheerfulness | 0.12 | 1.13 | <.05 |
| Model 6 ($n$ = 578) | | | |
| Sex | −0.22 | 0.80 | *ns* |
| Child cheerfulness | −0.10 | 0.91 | *ns* |
| Alcohol use | 0.04 | 1.04 | *ns* |
| Smoking | 0.37 | 1.45 | <.001 |
| Risk taking | −0.16 | 0.85 | *ns* |
| Mental health | −0.10 | 0.90 | *ns* |
| Model 7 ($n$ = 706, males only) | | | |
| Child permanency of mood | −0.12 | 0.89 | <.05 |
| Model 8 ($n$ = 522, males only) | | | |
| Child permanency of mood | −0.23 | 0.80 | <.01 |
| Mental health | −0.19 | 0.83 | *ns* |
| Education | −0.24 | 0.78 | <.001 |

*Note.* *N*s for analyses differ because of missing data per variable (especially smoking). *rh* = relative hazard; interquartile *rh* is presented.

Karp, & Morgan, 1989). Caution is needed in generalizing from this or any single sample, especially when cultural or cohort-sensitive variables are likely to affect a particular relationship; this data set is most valuable when used as a complement to the findings of other research, and its effect sizes are not directly generalizable to the current U.S. population.

Personality characteristics were assessed differently in childhood and adulthood, and indexes were constructed after the fact, using the best available information. These factors almost certainly attenuate the associations of these variables with one another and with mortality risk. If comprehensive personality measures, such as are available today, had been administered at each time point, it is quite possible that the observed associations between conscientiousness and mortality risk would be even stronger.

In terms of explanatory pathways, missing data on one or more of the control variables resulted in various exclusions from the final analyses. In some cases, the full models incorporating these control variables included only about half of the participants from the initial models. These exclusions decrease the power and perhaps the generalizability of the analyses, particularly in cases where four or five control variables are present. The present findings, although based on hard-to-obtain data, are therefore most useful for orienting future theorizing and research and for focusing shorter term biopsychosocial explorations of personality, behavior, adaptation, and health.

The ways in which personality relates to longevity are not simple, but this study provides striking evidence of the importance of the personality dimension of conscientiousness over a 70-year period. Complementing the recent results of other studies (e.g., Caspi et al., 2003; Christensen et al., 2002; Roberts & Bogg, 2004; Roberts et al., 2003; Weiss & Costa, 2005), our finding that a key individual-difference variable predicts a key outcome (longevity) many decades into the future strongly suggests that attention to the genetic, psychosocial, life-pathway, and physiological aspects of conscientiousness is now warranted. In terms of underlying psychophysiological third variables, studies hint that serotonin function may be relevant (Manuck et al., 1998; Wand et al., 2002; Williams et al., 2004), as serotonergic functioning influences variations in impulse control. Conscientiousness clearly has far-reaching implications and is likely one of the core health-relevant personality dimensions in humans.

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